

### REMARKS

In the Official Action mailed 13 May 2008, the Examiner reviewed claims 1, 3-7 and 9-36. The Examiner has rejected claims 1 and 3 under 35 U.S.C. §102(b); and has rejected claims 4-7 and 9-36 under 35 U.S.C. §103(a).

Applicant has amended claims 1 and 3. Claims 1, 3-7 and 9-36 remain pending.

#### Rejection of Claims 1-3 under 35 U.S.C. §102(b)

The Examiner has rejected claims 1 and 3 under 35 U.S.C. §102(b) as being anticipated by Shugar *et al.* (Commercialization of a Value—Engineering Photovoltaic Tracking System, IEEE 25<sup>th</sup> PVSC Proceedings May 13-17, 1996, p. 1537-1540).

#### Rejection of Claims 4-7, 9-21 and 25-33 under 35 U.S.C. §103(a)

The Examiner has rejected claims 4-7, 9-21 and 25-33 under 35 U.S.C. §103(a) as being unpatentable over Shingleton (6,058,930) in view of Shugar *et al.*

#### Rejection of Claims 22-24 under 35 U.S.C. §103(a)

The Examiner has rejected claims 22-24 under 35 U.S.C. §103(a) as being obvious over Shingleton (6,058,930) as applied to claim 21 above, and in further view of Osterwisch (5,758,938).

#### Rejection of Claims 34-36 under 35 U.S.C. §103(a)

The Examiner has rejected claims 34-36 under 35 U.S.C. §103(a) as being obvious over Shingleton (6,058,930) as applied to claim 33 above, and in further view of Laing *et al.* (5,445,177).

#### The Cited Art

**Shugar et al.** discloses a photovoltaic array tracking system in which a number of PV panels are mounted to some type of frame. Each tracking system includes three legs on two foundations, with the concrete foundations poured in trenches. The tilt axis is a tilted polar axis. Each system is operated individually to pivot between morning and evening orientations.

**Shingleton**, at Figs. 2A-2C, 9A and 10 illustrate solar tracker array 30. Each array includes a row of solar panels 34 supported by a torque tube 32 which is journaled in bearings 40 on top of piers 36. The piers 36, and therefore the row of solar panels 34, are oriented in a north/south direction.

(See claim 1.) Torque tube 32 is rotated about its axis by a linear actuator 42 so that the row of solar panels 34 can be tilted from an east facing orientation (Fig. 2B) to a mid-day orientation (Fig. 2A), to a west facing orientation (Fig. 2C). Adjacent rows of solar panels 34 may be tilted or racked back and forth by separate actuators 62 (Fig. 7) or by using the same linear actuator 42 (Figs. 8-10) by coupling the ends of adjacent torque arms 46 to one another using link members 68.

**Osterwisch** discloses a drive mechanism 10 including a lower bar 12 pivotally connected to a pedestal 16 and an upper bar 14 pivotally connected to lower bar 12 and to a support arm 18. Pedestal 16 is fixed to ground 20. (3/14-23) Linear actuator 32 has one end connected to support arm 18 and the other end connected to the junction of bars 12, 14. (3/58-62) The lower bar 12, upper bar 14, pedestal 16 and a support arm 18 create a 4-bar linkage to permit 180° elevational rotation by the actuation of linear actuator 32. "The linear actuator member acts as a strut or a brace that assists the mechanism in resisting compression and tension forces." (2/30-41)

**Laing** discloses at Fig. 1 a solar concentrator including a water-filled a concrete trough 1 in which a steel frame 2 floats. Ropes 3, 4 run perpendicular to each other and are supported by frame 2. The frame is centered and rotated by rollers 8. The movement of frame 2 is such that ropes 4 remain parallel to the sun's rays. (4/10-23) Fig. 3 shows a modular energy conversion unit including a frame 36 and a roof element 30 supported by and connected to frame 36 by metal struts 34 and cables 34a. Roof element 30 acts as a Fresnel lens to concentrate solar radiation onto a focal line 39. Ropes 3 and 4 are connected where they cross and act to guide and position each energy conversion unit. The Fig. 4 embodiment uses struts 44 offset from the center of the unit so as not to obstruct the sun's rays.

### The Claimed Invention Distinguished

**Claim 1** was previously amended to specifically clarify that the solar panels are secured to the torsion to an acute angle to the torsion tube axis with the solar panels located entirely vertically above the torsion tube axis at the noontime angular orientation.

An example of the invention of claim number 1 is shown in Figs. 19-24 and discussed in the related paragraphs 58-60. Paragraph 59 discusses the significance of this invention and some of the advantages accruing with this invention.

[0059] It has previously been assumed that because the major design determinant for the torque tube size and cost is the torque on the torque tube, that it was essential to minimize

both the torque generated by dead weight and the torque generated by wind force. However, through detailed investigations and analyses it has been determined that 1) the wind torque is actually highest when the torque tube rotational angle is relatively low (for example 10-20 degrees) and lowest when the rotational angle is highest (typically 45 degrees); and 2) the dead load torque is lowest at relatively low rotational angles and highest at high rotational angles. Therefore, increase in y distance to the cg of the tilted PV modules 34A of Figs. 19-24 does not lead to a significant increase in the design maximum torque delivered to the torque tube. Based upon this quite unexpected result, it has been determined that the size and cost of the torque tube does not increase significantly for the tilted (Figs. 19-22) vs. horizontal (Figs. 1-18) configurations.

The Examiner has rejected claim 1 stating in part "the improvement comprising mounting structure securing the solar panels to the torsion tube at a chosen angle (20 and 45 degrees) to the torsion tube axis (Design Features p. 1539 and Figure p. 1537)." This is incorrect. The 20° angle refers to inclination of the torque tube (as shown in the figure on page 1537) and the 45° angle refers to the rotation of the torque tube about its axis as the PV panels move between east facing and west facing orientations. There is nothing in Shugar *et al.* suggesting that the PV panels be oriented at angle to the torsion tube. Therefore claim 1 is not anticipated by Shugar *et al.* It would not have been obvious to modify the art to arrive at the invention of claim 1 because, as discussed at paragraph 59 of the application, the advantages of doing so were not recognized.

Accordingly, claim 1 is allowable over the cited art.

**Claim 3** has been amended to incorporate the substance of originally filed claim 1. The Examiner has rejected claim 3 by, applicant submits, interpreting the words of the claim to cover inappropriate structure. First, insofar as the undersigned can understand, the Examiner has stated that the solar panels disclosed in Shugar *et al.* constitute the first and second plates of claim 3. However, the solar panels do not constitute mounting structure; to the contrary, they are the structure being supported. If this interpretation of the claim rejection is not correct, please provide a clarification, perhaps with an annotated drawing figure. Second, the Examiner appears to consider that the generally triangular torsion tube portions of the first and second plates are provided by the Multiple Point Foundations of Shugar *et al.* This, applicant submits, does not make sense. The Examiner is

first taking the position that the solar panels constitute the first and second plates but then is also taking the position that the Multiple Point Foundations constitute the triangular torsion tube portions of the first and second plates. The remaining statements regarding claim 3 are similarly deficient. Accordingly, claim 1 is allowable over the cited art.

Regarding **claim 4**, the Examiner states that Shingleton does not show the following element of claim 4.

the second support point 232 of the second solar collector support structure pivotally connected to and supported by the second and third North side supports 217, 218; ... .

The Examiner takes the position that this deficiency is provided by Shugar et al. Applicant disagrees. If one were to have a row of PV systems of the type disclosed in Shugar et al., the PV systems would not be connected to one another. Therefore, the second support point of a second solar collector support structure would not be pivotally connected to and supported by one of the North side supports used to support the first solar collector support structure. With reference now to figures 25 and 28, it can be seen that the leftmost, or first, tracking solar collector 202 and the second tracking solar collector 202 essentially share second north side support 217. There is nothing in Shugar et al. suggesting such an arrangement. Accordingly, claim 4 is allowable over the cited art.

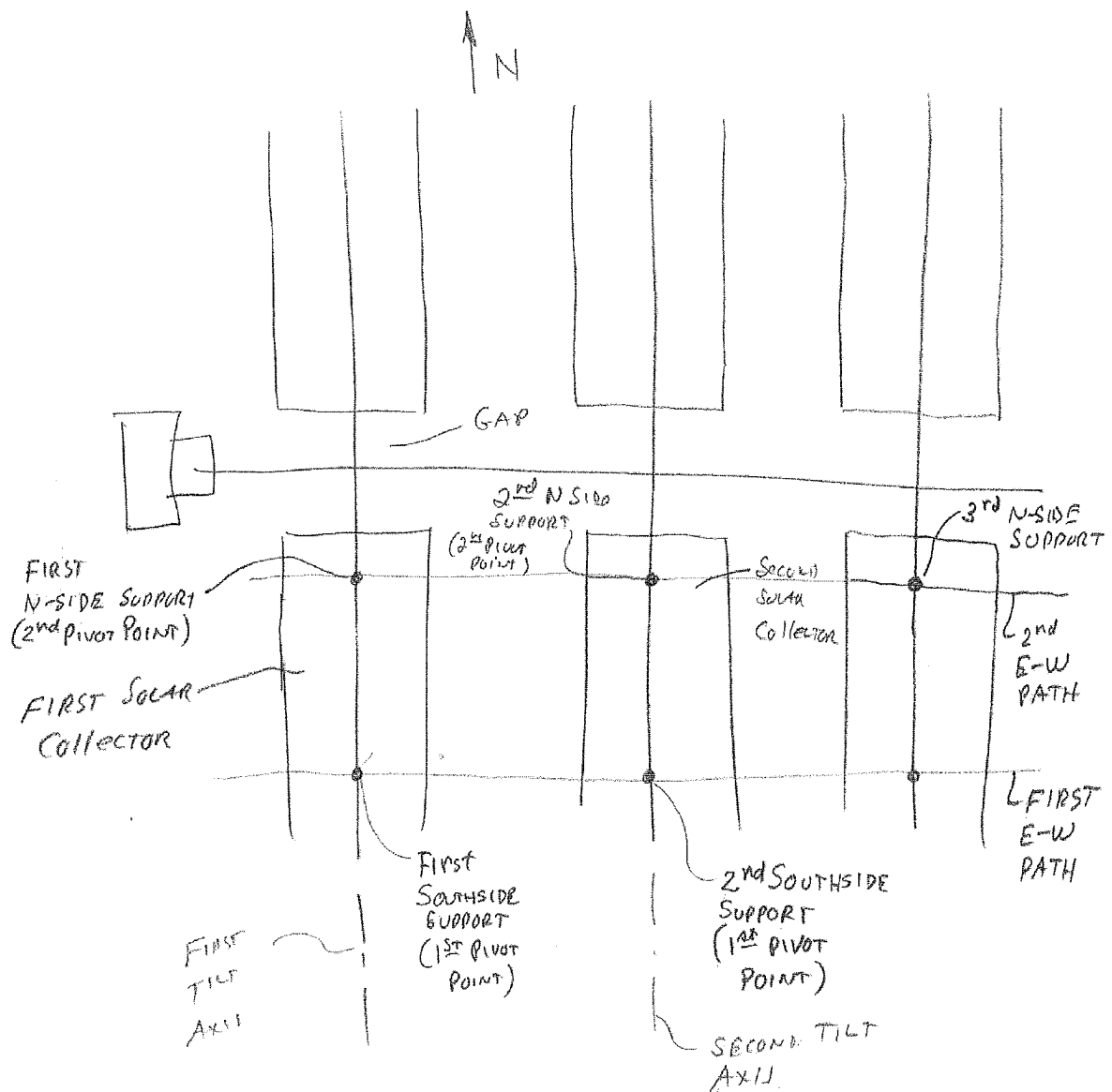
**The dependent claims** are directed to specific novel subfeatures of the invention and are allowable for that reason as well as by depending from novel parent claims. Please see the following examples.

**Claims 14 and 15:** the second North side support/upper support (36) of Shingleton is not laterally midway between the first and second tilt axes but rather is aligned with the second tilt axis.

Response to the Examiner's Response to Arguments

On page 4 of the Office Action the Examiner states "As shown in Figure 10, Shingleton depicts the second support point of the second solar collector support structure/pier support (36) ... is pivotally connected to and is supported by the second and third North side ... supports/upper pier supports (36) ... ." This characterization of Shingleton is incorrect. Using the terminology of the following annotated figure 9A, the first north side support (pier 36) of Shingleton is connected to torque tube 32 at the second pivot point; the second North inside support in the adjacent row is not

connected to anything in the first row. If the Examiner disagrees, please provide a fully annotated sketch or drawing supporting the Examiner's position.



FROM FIG. 9A of Shingler et al. 6,058,930

**Claims 16, 17, 19:** piers 36 of Shingleton are not laterally offset but are positioned directly beneath the second tilt axis.

Response to the Examiner's Response to Arguments

Shingleton is stated to depict a plurality of piers/support posts 36 laterally offset with respect to "the center point". Even assuming, for sake of discussion, that piers/support points 36 are laterally offset with respect to "the center point" (whatever that is), such a position does not support the rejection of the claims in which each base is specified to be laterally offset from the tilt axis.

**Claims 22-24:** Shingleton fails to disclose or suggest that piers 36 could be anything but pier type compression members, as opposed to a combination of pier type compression members and tension members (cable type or other types).

Response to the Examiner's Response to Arguments

While Osterwisch may have characterized the linear actuator as a strut or brace, it fails to disclose or suggest the combination of claim 22 (which incorporates claims 4 and 21). Rather, it is concerned with forces exerted by the solar panels on the actuator (the tilting assembly in claim 4), not forces exerted on the support structure. Assuming, for sake of discussion, that it would have been obvious to combine Shingleton and Osterwisch, the likely combination would be to replace the drive mechanism of Figs. 1A-1C of Shingleton with the four-bar linkage and linear actuator of Osterwisch. There is nothing in the art suggesting modifying the north side supports of applicant's claimed invention.

**Claims 33-36:** With Shingleton, there are no laterally extending support elements aligned with any gap so that tilting does not cause the nonexistent laterally extending support elements to pass through the gaps.

Response to the Examiner's Response to Arguments

The Examiner has combined Laing with Shingleton and states that it would have been obvious to use the support struts/flexible cable/rods of Laing with the photovoltaic panels support assembly of Shingleton to not obstruct the sun's rays. However, that is not what is claimed. What is claimed in claim 33 is that at least one of the north side supports comprises laterally extending support elements that extend generally perpendicular to the tilt axis and are aligned with the gap defined between the solar collectors so that laterally extending support elements pass through the gap

when the assembly is tilted. There is nothing in the cited art that discloses or suggests this aspect of the invention.

### CONCLUSION

In light of the above remarks and the amendments to the claims, applicant respectfully submits that the application is in condition for allowance, and action to that end is urged. If the Examiner believes a telephone conference would aid the prosecution of this case in any way, please call the undersigned at (650) 712-0340.

The Commissioner is hereby authorized to charge any fee determined to be due in connection with this communication, or credit any overpayment, to our Deposit Account No. 50-0869 (PWRL 1030-3).

Respectfully submitted,

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